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It was Dutrochet's theory, that this action is due to the sudden transfer of fluid from the inner to the outer cells of the wall of the capsule. Dr. Wyman had demonstrated the impossibility of this, by dissecting away the outer layers of cells without impairing at all the contractility of the capsule. He had himself come to the conclusion, that the motion is due to the spontaneous contraction of the cells on the contracting side, in the way that motion is produced in the hydroid polyps. In the contracted capsule the cells on the concave side are found to be shortened, while those on the opposite side are elongated. In the Balsam capsule the contraction is so sudden that the shortening of the cells cannot be watched, but in the Echinocystis the motion is so gradual that the change can be observed under the microscope. When gradually subjected to the action of anæsthetic agents, the capsules lose their contractility; but when suddenly placed under their influence, an immediate contraction is the usual result.

Four hundred and seventh meeting.

December 12, 1854. — QUARTERLY MEETING.

The PRESIDENT in the chair.

Dr. Durkee read a paper on the Common Mosquito, *Culex pipiens*, giving a description of the microscopic structure of its proboscis, with an account of its development and habits of reproduction.

On motion of the Treasurer, the following vote was passed: —

"Whereas, the American Academy of Arts and Sciences has received notice from the executors of the will of the late Samuel Appleton, that they have transferred to this society stocks amounting to ten thousand dollars, from the fund left for distribution by Mr. Appleton, —

"*Voted*, That the Academy accepts with much gratification this contribution to the cause of Science from one who found his happiness in acts of beneficence, and that our thanks are due to the executors of his will for the direction which they have given to his bounty."

Professor J. Lovering made a brief communication, describing new experiments and modes of illustrating the laws of Light and Sound.

" 1. At the meeting of the American Association for the Advancement of Science, at Cleveland, in August, 1853, I gave an account of some changes, and, as I believed, improvements, in the construction of Soleil's apparatus for projecting on a screen the chromatic phenomena of polarization. As the volume which is to contain the proceedings of that meeting has been unusually delayed in its publication, and has not yet appeared, I propose to present now to the Academy the substance of my former paper. The apparatus of which I speak, as made by Soleil, is described in Pouillet's *Traité de Physique*, and elsewhere; and a sectional view of it is given on Plate XXXIV., Fig. 21, of the book first mentioned. I here present the apparatus as I have modified it. Soleil's plan is well adapted to many experiments. If the crystal is small, it is placed near the focus of the large lens, which condenses the light upon it and illuminates it strongly, so that the colored rings, black crosses, &c. developed by the analyzer may be projected upon a distant screen on an enlarged scale. But whenever these experiments are to be repeated with crystals of low crystalline power, as quartz, for example, some modification of the apparatus is necessary. Otherwise, it will be impossible to see anything more than the colored centre without the rings. A more diverging beam of rays is required for the rings. Thus have I been led to the construction of another eyepiece, to be substituted in such cases for that which accompanied the original apparatus. It

Fig. 1.

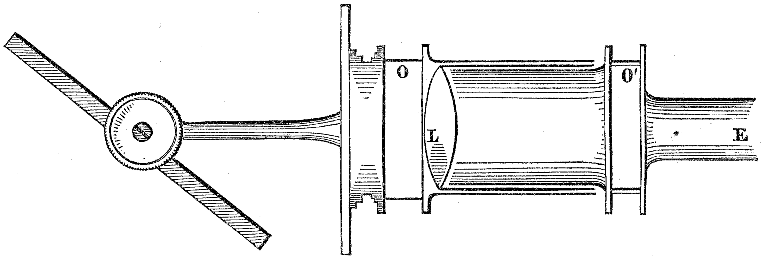
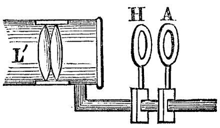


Fig. 2.



is represented in Fig. 2. The two small lenses, L′, having with their united forces a focal length of less than an inch, receive the converging rays as they come from the large lens, L, and make them still more convergent. It is necessary that the quartz should be adjusted very near the focus of the rays, and also that the analyzer should be placed as closely as possible in front of the quartz. Otherwise, this highly divergent pencil of light, after it leaves the focus, will not be able to get through the small area of the crystal and analyzer, and therefore the whole field of view will be curtailed. The crystal and analyzer are held by separate rings, which are supported on uprights which slide independently upon a horizontal bar, and the two rings may, therefore, be pushed as closely together as the thickness of the crystals will allow.

" In Soleil's apparatus, there is an opening, such as is seen at O of Fig. 1, similar to that made in magic-lanterns, and for the same object, namely, the introduction of the frame containing the object to be magnified. When Soleil's apparatus is used for the inspection of large objects, such as pieces of tempered glass or artificial selenite figures, they are introduced at this opening, and in these cases the large lens serves as a magnifying-glass, and there is no condensing lens to help the illumination. This defect would not be felt with very large objects, as large, that is, as the lens itself; because the object itself would receive immediately as much light as the lens could throw upon it. But the objects to be examined are seldom, if ever, of this magnitude. Hence, much of the light which might otherwise be saved, is lost for want of a condensing lens. In order that the apparatus may retain all the advantages which belong to it in its original form, I have retained the opening O, which may still be used in any cases where it is preferred. But the tube which carries the large lens has been divided at the middle of its length, and one part made to slide in the other. Another opening, O′, similar to that in the original apparatus has been joined to one end of the interior tube. By pushing more or less of this tube into the next exterior one, the objects placed in the new opening can be put at smaller or larger distances from the principal lens, which is to this opening an illuminating lens. The best distance, in any given case, is that which makes the section of the cone of rays by the object equal to that part of its own area to be examined. When large pieces of quartz, the tempered glass, or selenite figures, are examined under these circumstances, the superiority of the illuminating arrangement is very decided, and allows of the picture being displayed on a much larger scale than would be otherwise practicable.

"2. Since Newton's prime experiment on the prismatic dispersion of white light, many contrivances have been used to produce the synthetical counterpart to this grand result of experimental analysis. The various methods of uniting the prismatic colors again, so as to restore the white light, are enumerated by Moigno, in his *Repertoire d'Optique*, Vol. IV. p. 1370, as given by Dove.

"It is desirable to obtain the original pure prismatic tints, and then unite the rays, if possible, by some process independent of refraction, and involving no obscure process. Von Münchow does this by giving a reciprocating motion to the prism, and Steinheil, by turning a prism, one side of which is ground or blackened so as to intercept the light, rapidly round an axis parallel to the refracting edge. In either case, as soon as the motion acquires a certain velocity, the colored spectrum vanishes, and a streak of white light appears in its place. This subjective mixture of the colors may be effected in a cheaper manner, by any one in possession of a water-prism, as follows. The light is introduced through one of the inclined glass sides of the prism, at such an angle as to emerge from the upper surface of the water. If the prism stands firmly upon a table, a spectrum will be projected upon the ceiling of the room. But a moderate tap with the finger upon the table will communicate a rapid vibration to the hollow prism, and thence to the water contained in it, and the little change in the refracting angle which ensues will make the spectrum dance backward and forward in the direction of its length. As soon as the dance begins, the spectrum, which hitherto had been of the usual colors, is converted into a long streak of white light.

"3. The only remaining experiment to which I shall allude in this communication carries us out of the province of Optics, and into that of Acoustics. It is well known that, when a tube filled with air is skilfully blown by the mouth at the embouchure, or a vibration in the inclosed column of air is otherwise excited, it is capable of rendering, without any fingering and without holes to finger, a certain series of sounds, which are called *harmonics*. In the humming-top, we may presume that the reaction is the same between the air inside and outside of the top, as it is in the musical pipe : the only difference being, that in one case the air is driven by the mouth against the lip of the embouchure, and in the other the lip of the top is made to strike against the air. I have not been able to find any allusion to the question whether the note which the top yields varies with the force of the blast which the top itself gives by its own motion. But I have succeeded myself in producing two of the harmonics, that is, one besides the fundamental sound. Success in this experiment requires that an extraordinary velocity should be given to the top, greater than is possible except when the top is small. But if a small top is started with great energy, it gives out at first a high sound. As the velocity slackens, this sound dies out, and the top is silent for some time. Afterwards, as the motion diminishes, another and lower sound starts up, which is the one commonly heard in humming-tops, and the only one possible to excite by the usual way of starting the top, if it is large. This curious experiment may be worth recording, as carrying one step further the analogy between the theories of the sounds of the humming-top and of other wind instruments."

Mr. Sherwin alluded to a phenomenon accompanying the recent burning of a large building in Cambridge. The appearance to him, at the distance of several miles, was that of a tall column of light elevated about 20° above the horizon, appearing at first like some extraordinary meteoric phenomenon. It might be accounted for, he thought, by a series of reflections from clouds at different elevations, or perhaps more probably by mirage. In 1811 he had seen a similar appearance 24° high, which proved to have been caused by the burning of a paper-mill forty miles off.

Professor Horsford exhibited specimens of Cochituate water, together with the various products of his recent examination and analysis of it.